Initial Findings: Respiratory Airflow in Working Individuals Wearing Chemical Protection

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Subject Characteristics
(mean ± SEM)

N = 48

Age = 22.0 ± 0.4 yrs

Height = 178.6 ± 1.0 cm **Weight = 80.1 ± 1.5 kg**

VO_{2max} = 48.6 ± 0.9 mL/kg/min

PIFR = 367.8 ± 14.4 L/min

FVC = 5.40 ± 0.13 L **$FEV_{1.0}$ = 4.49 ± 0.11 L**

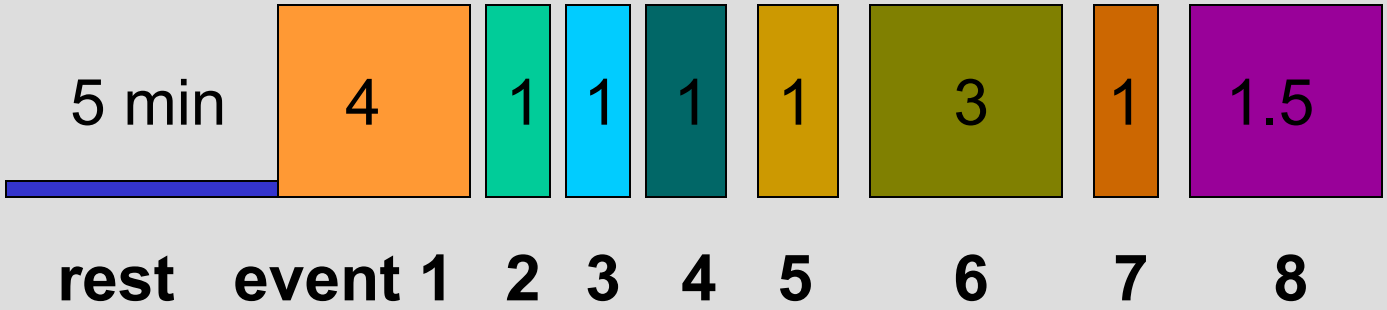
$FEV_{1.0}$/FVC = 0.84 ± 0.01

Approximate C2A1 Filter Wt = 288 g

Added components = 126 g

Clothing & equipment weight = 11.0 ± 0.5 kg
Weighted vest = 22.7 kg

Firefighter Agility Test



Nominal event duration, min

(does not include walking between events)

Mean exertion duration (± SEM)= 19.1 ± 0.4 min

Environmental Conditions: dressing area (Tdb = 20.4 C, RH = 65%)
work area (Tdb = 21.8 C, RH = 73%)

Firefighter Agility Test

Event #1: Stair Climb

Event #2: Hose Drag

Firefighter Agility Test

Event #3: Equipment Carry

Firefighter Agility Test

Event #4: Ladder Raise

Event #5: Forcible Entry

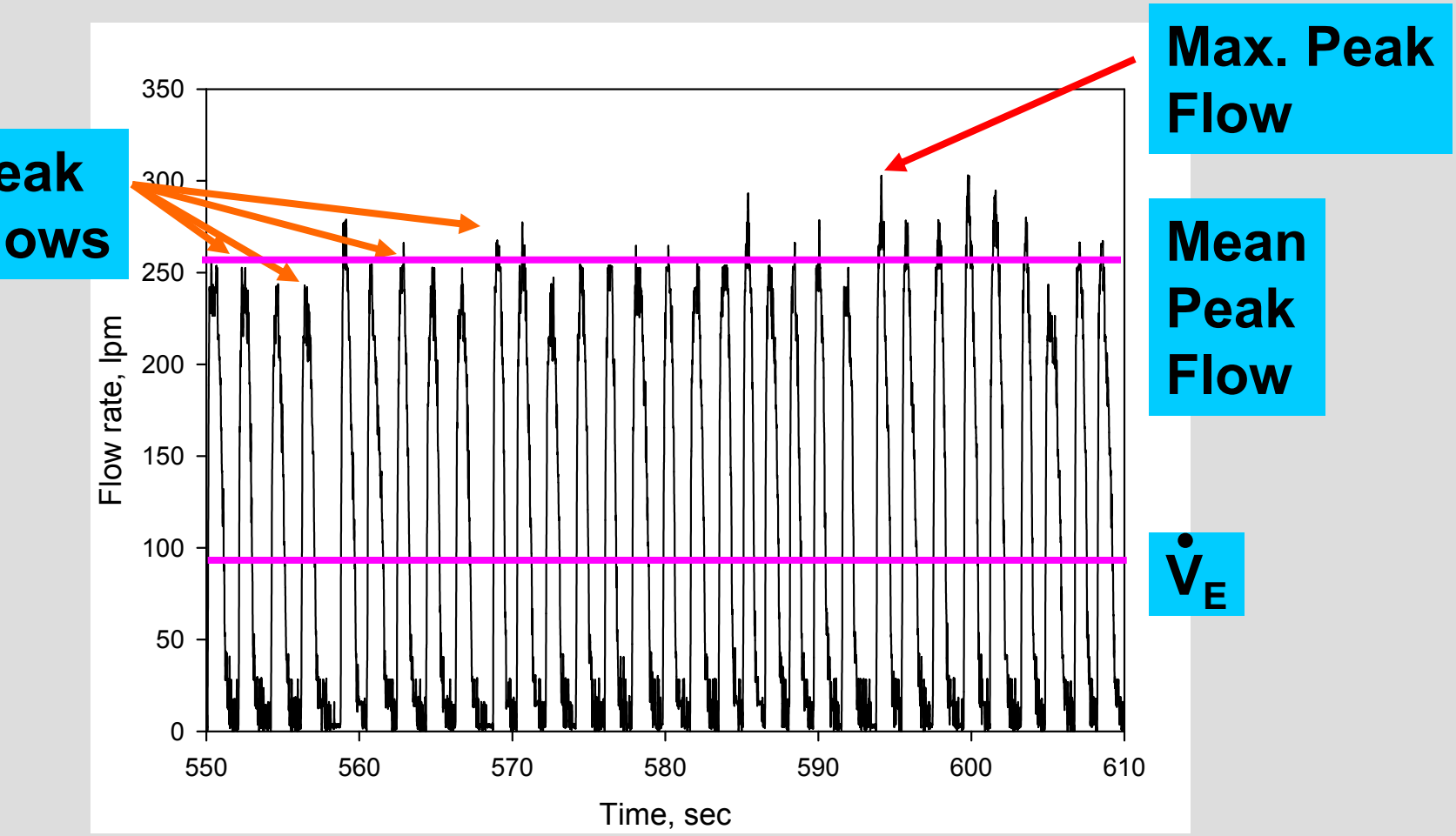
Firefighter Agility Test

Event #6: Search

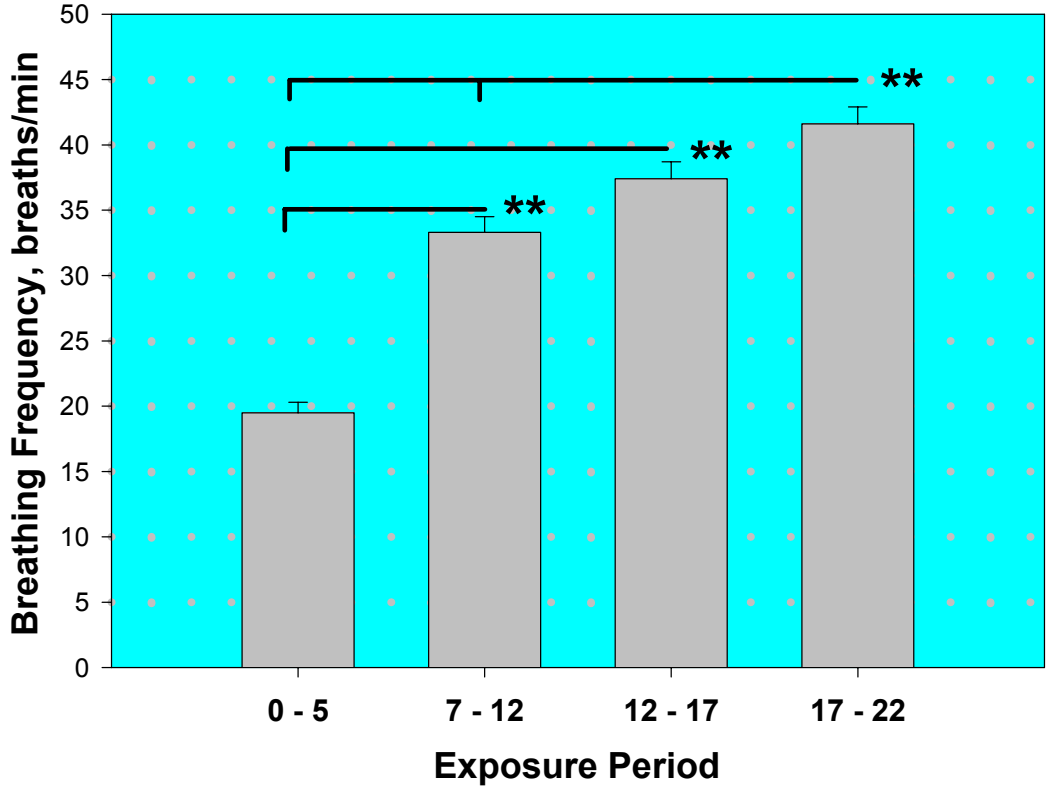
Firefighter Agility Test

Event #7: Rescue

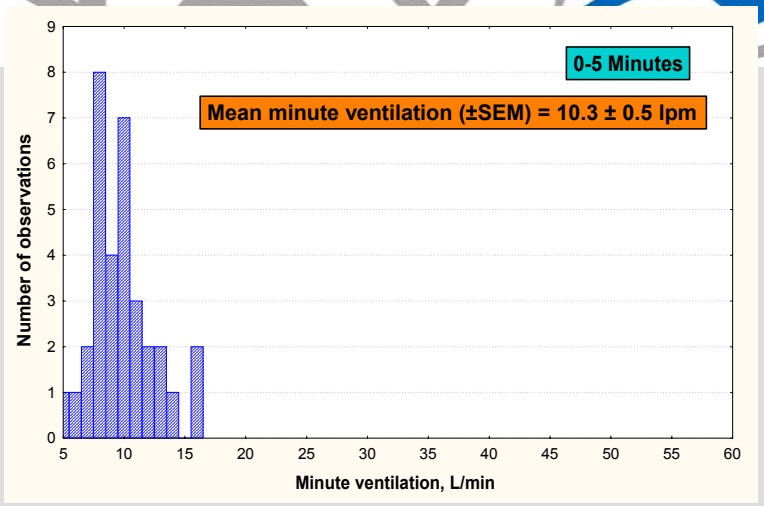
Event #8: Ceiling Breach & Pulldown

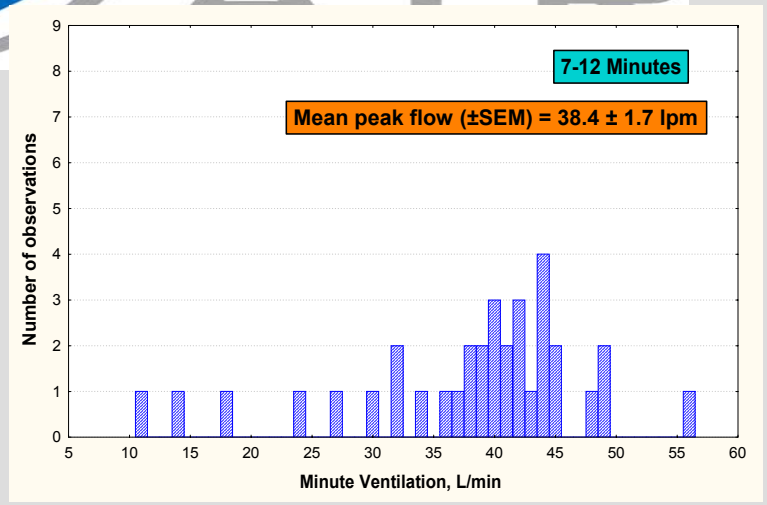


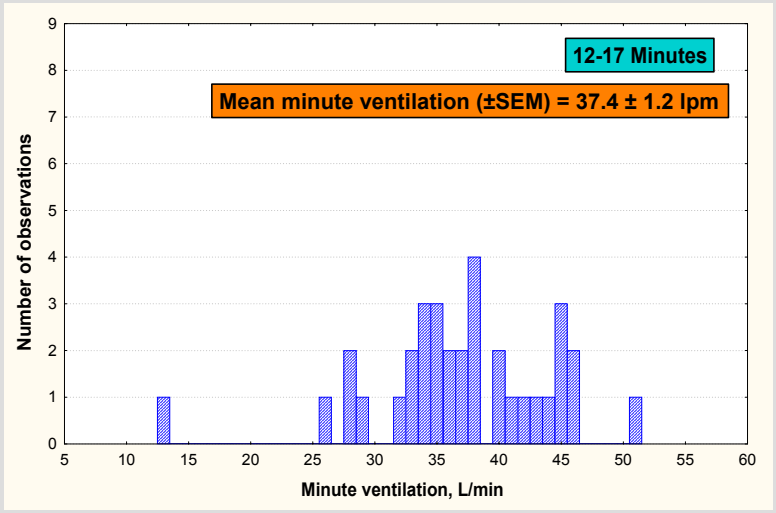
Typical airflow pattern during exertion phase

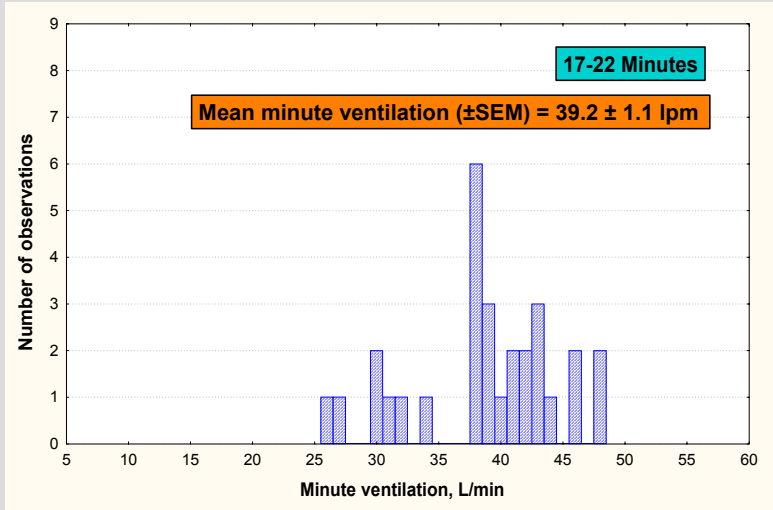


Breathing frequency by exposure period



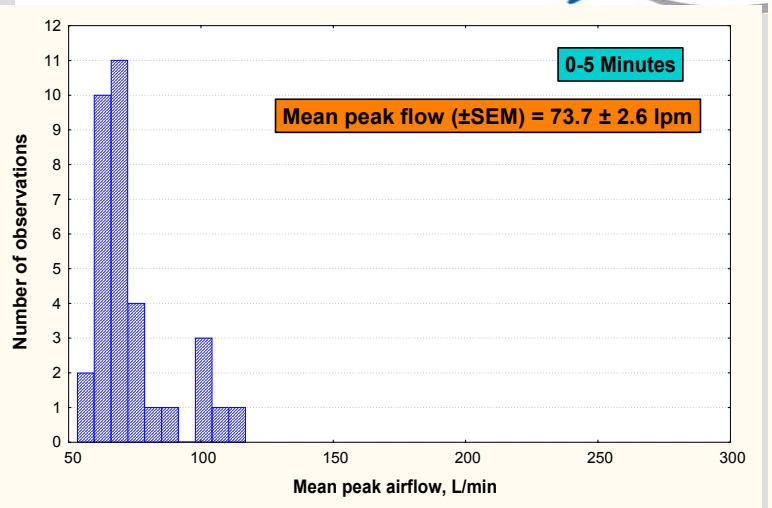


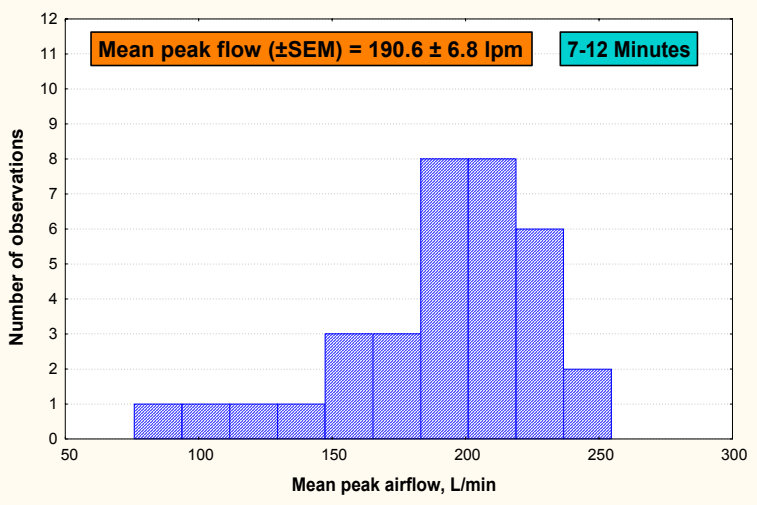


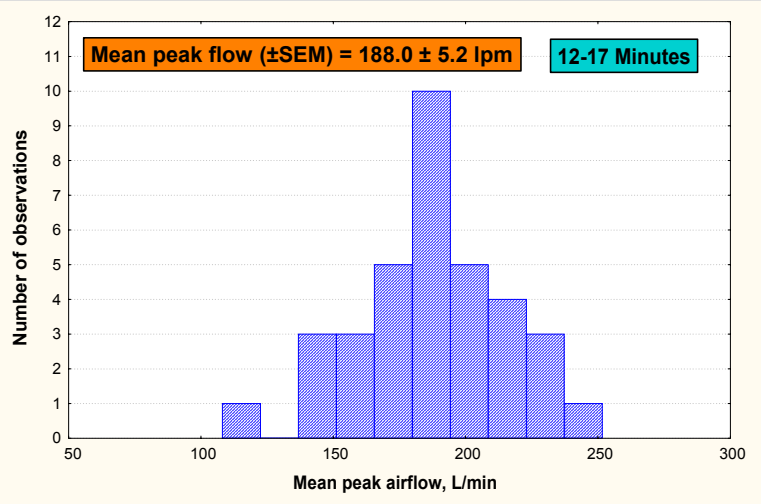


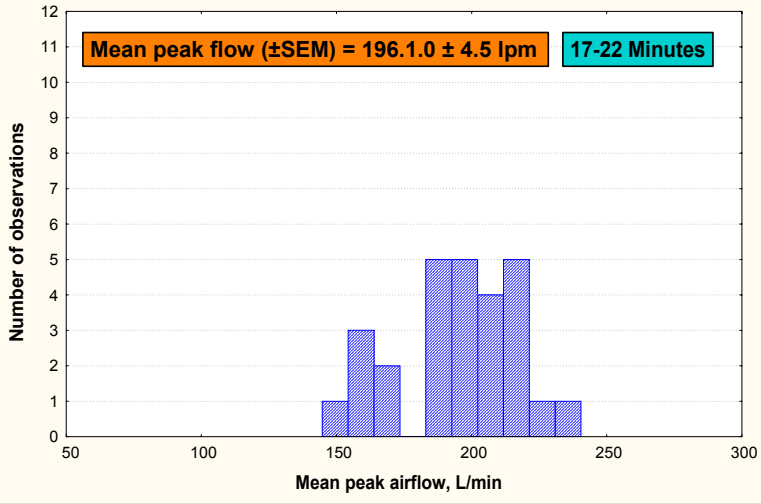
Minute Ventilation

(Note: values approx. 2X indicated on graphs)

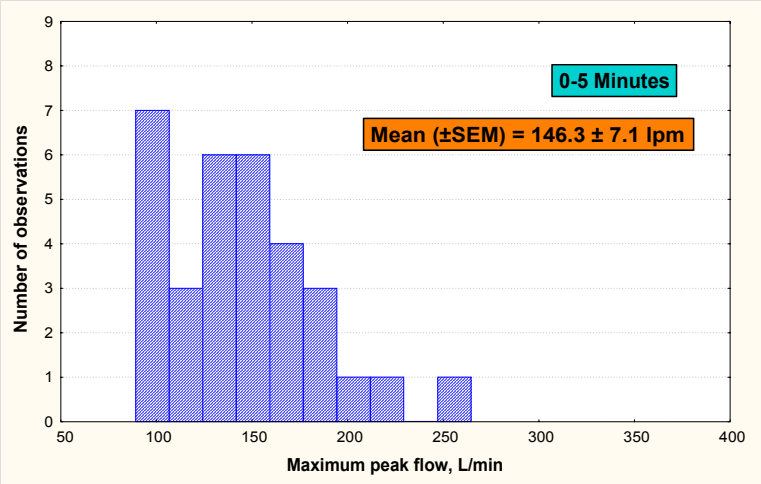


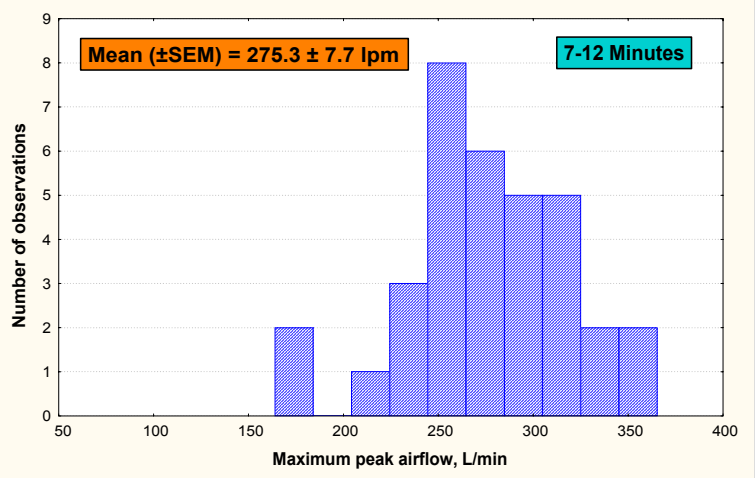


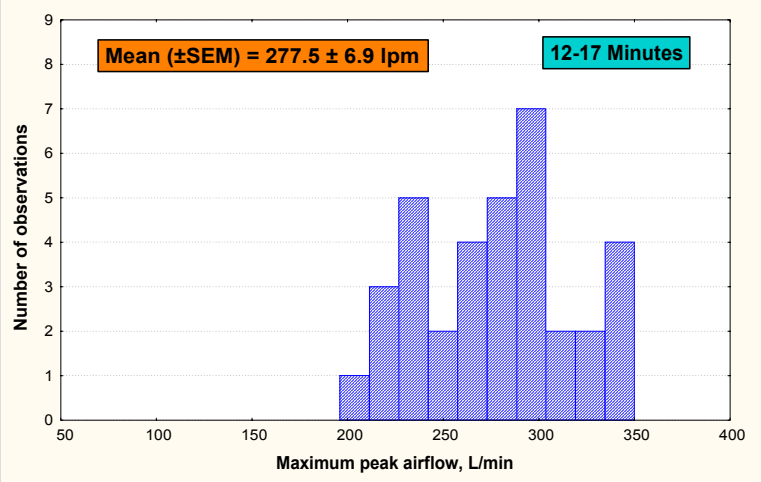


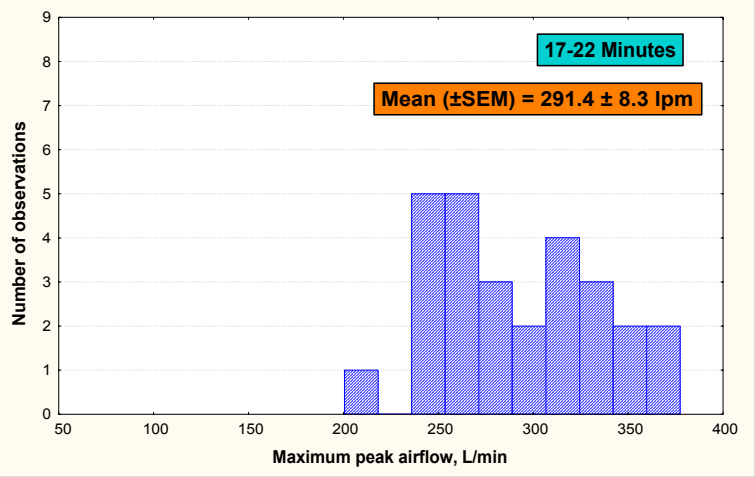


Peak Airflow, Mean

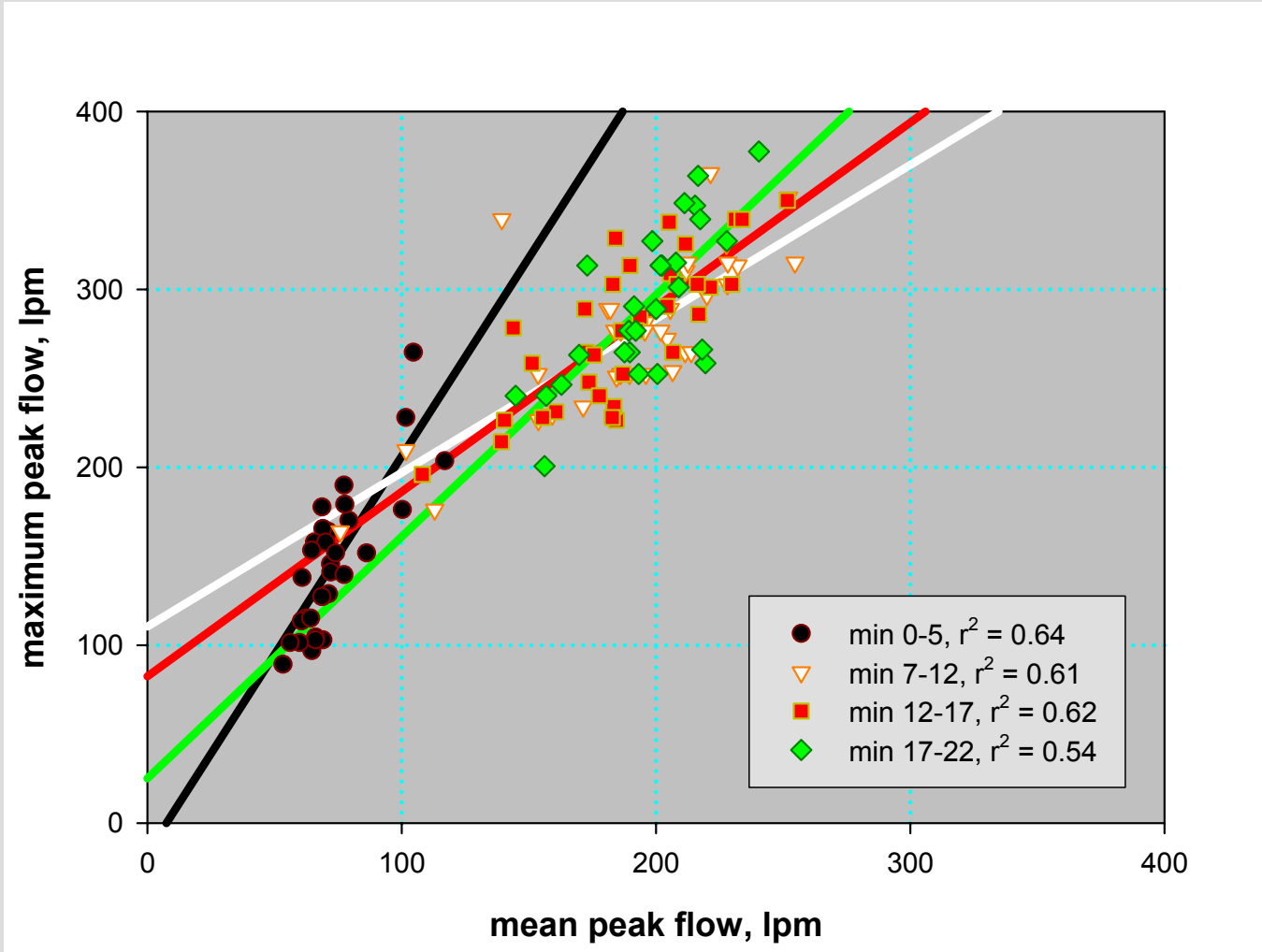




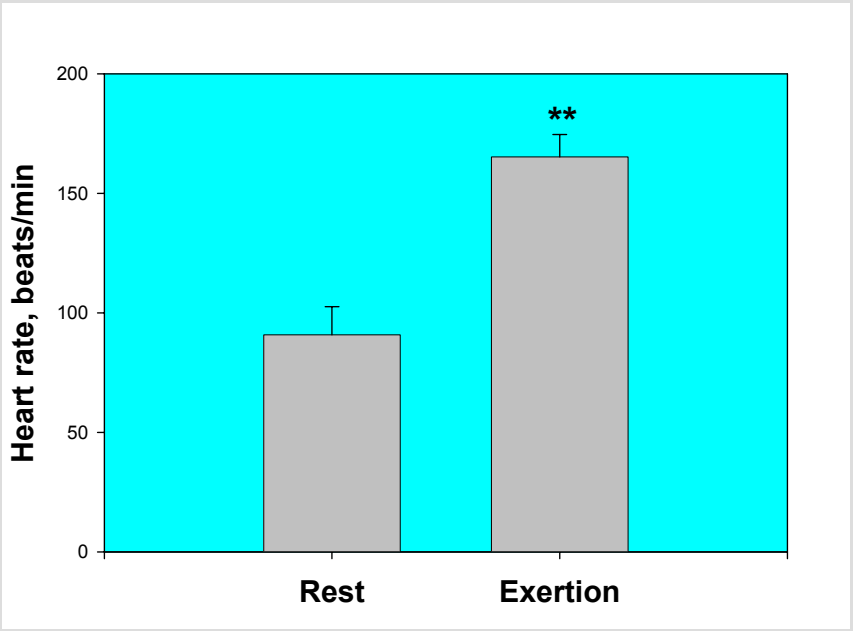




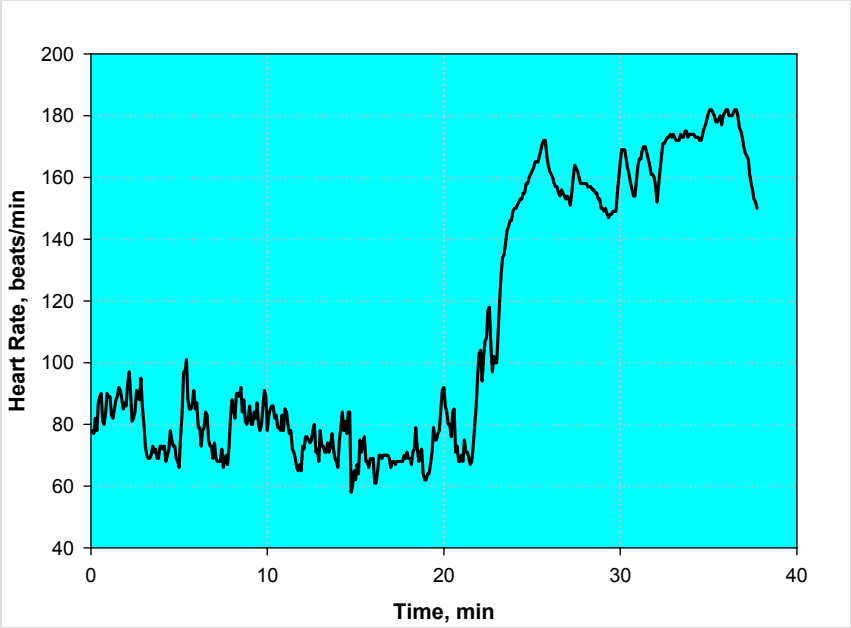
Maximum Peak Airflows



Relationship of mean to maximum peak flow rates



Typical heart rate results



Mean Heart Rates:
rest = 90.8 ± 1.8 bpm
exertion = 165 ± 1.5 bpm

Summary

- Mean peak flows of 196 lpm were observed during the final 5 minutes of exertion
- Maximum peak flows averaged 291 lpm during the same period
- Minute ventilation rose to approximately 78 lpm during this period at a breathing rate of 42 breaths/minute
- Breathing variables were significantly different between rest and exertion periods
- Correlation between baseline physiological parameters and respiration variables was weak or nonexistent

Acknowledgements

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